NOTES ON THE EMBRYOLOGY OF SOME NEW ENGLAND ORCHIDS.[1]

R. G. LEAVITT.

(Plate 33.)

OWING to the fact that work on the native orchids was planned late last season, the material at present in hand represents only advanced stages in the development of the embryo in most cases. Yet even this has shown some things that are of considerable interest. The remarkable diversity which prevails in orchids with respect to the suspensor is well illustrated; and the ripened seeds have shown so many instances of polyembryony of a particular type that one might suspect such polyembryony of being a family characteristic.

GOODYERA TESSELATA and PUBESCENS. The embryos of both these species (Figs. 1, 3, 4) seem to lack the suspensor. That such is the case with *G. pubescens* is clearly indicated by the few-celled stage represented in Fig. 3. The hemispherical terminal cell (*c*) doubtless represents the suspensor; but it goes to form a permanent part of the embryo proper. In *G. discolor*, according to Treub,[2] this cell pushes out of the embryo-sac, elongates to thrice the length of the mature embryo, and serves to bring food-matters from the basal region of the developing seed, to the coat of which it is closely applied, though it does not reach the ovary wall itself, the source of supplies.

Listera ovata and *Epipactis palustris* are figured by Treub[3] and are shown to develop no suspensor. So that we have with *Spiranthes cernua* and the (probable) case of *Goodyera pubescens* representatives of four nearly related genera in which all cells derived from the fertilized egg are included within the germ itself. Usually in angiosperms the egg-cell after fertilization divides transversely into two cells. The one toward the centre of the sac ("embryo-cell") ultimately gives rise to a large part, and sometimes to the whole, of the embryo proper. The other produces the suspensor, generally a row of cells attached by the end to the wall of the sac, and acting to

[1] Continued from p. 63.

[2] Notes sur l'embryogenie de quelques Orchidées, pl. IV.

[3] Op. cit., pl. II., III.

push the embryo down into the nourishing endosperm, or to draw nutritives from the nucellus. The suspensor finally perishes. Fig. 2 illustrates the usual differentiation of the new monocotyledonous individual into two regions, suspensor and "embryo proper"; though in this species (*Limnocharis emarginata*) the end-cell of the feeding-organ is uncommonly large. That the simplification of the germ, characteristic of the orchid family, should in the above named species include the omission of so radical a step in early development as the differentiation of the embryo into temporary and permanent regions, is a noteworthy feature of the embryogeny.

Polyembryony. Occasional doubling of the embryo has been noted heretofore in a small number of orchid species, including representatives of *Cypripedium*, *Orchis*, and *Gymnadenia*. I find twin embryos in both the present species of *Goodyera*. Apparently here as in certain ascertained cases both embryos originate in the same sac, though I have seen examples only in the ripe seeds. However, both are often plainly invested by a common membrane, probably the remains of the sac with contiguous cells. Strasburger supposed that in the double-embryoed species there are occasionally two egg-cells in the same sac.

The percentage of polyembryonous seeds must be very small, though I have been able to find from one to three or four instances in each slide of seed examined. The close appression of the embryos — one being smaller than the other and lying more or less in a concavity of the larger one — makes it rather hard to distinguish the twin-seeds from the rest. It should be mentioned that supposed hybrid seed (from pollen of *G. tesselata* upon *G. pubescens*) gave a much larger proportion of twins than seed of either parent.

APLECTRUM HIEMALE. Double embryos (Fig. 7) occur about as frequently as in the *Goodyera* species. Both members of the pair have the remains of suspensors (*s*). This fact is important as indicating similarity of origin, and precluding the idea that doubling results from fragmentation of an original single embryogenic mass.

CORALLORHIZA MULTIFLORA. As seen in the nearly ripened seed (Fig. 8) the suspensor (*s*) comprises two very long cells. It is plainly an organ of absorption, for it passes out of the exostome and plunges its tip into the tissue of the placenta.

I have found, after much looking, a single two-embryoed seed. The embryos were very closely pressed together, but each had its suspensor.

HABENARIA TRIDENTATA. In diembryonic seeds, which are not uncommon, the embryos lie side by side (Fig. 6), have separate suspensors (*s*), and are similarly oriented.

HABENARIA BLEPHARIGLOTTIS. When two embryos are present (Fig. 5), they are plainly to be seen, as one lies ordinarily a little above the other and both embryos keep their roundness well. The proportion of twin-seeds is small.

This species shows a somewhat striking elaboration of the suspensor, which comprises at least six or seven cells (Fig. 10). Nearly all the cells emit processes, some short and fingerlike and reaching out laterally to the seed-coats or placenta, others filamentous and running parallel with the body of the suspensor into the tissue at the base of the seed-stalk. All these prolongations are filled with dense protoplasm. The processes of the terminal cells are insinuated between the cells of the placenta. The whole apparatus seems to be a well-devised instrument of nutrition.

The embryo lies at the centre of the field which every now and then we hear characterized as peculiarly exempt from modifying influences. Features of the reproductive system, so it has been said, are relatively constant from group to group in any evolutionary series, as compared with characters of the vegetative system. Yet as a matter of fact the moulding forces reach even the embryo rather directly in many cases. Thus in the family under discussion the adaptive tendencies in the matter of seed-dispersal have worked first to reduce the size and specific gravity of the seed as a whole. The mature seed has but one coat and that is air-filled. Both perisperm (nucellus) and endosperm have been done away with. The germ itself has lost distinction of stem and leaf. Finally, in the absence of the usual means of feeding the growing embryo, complicated sucking-organs (suspensors) have often been developed; and the diversity which obtains within the limits of this one family in this respect is remarkable. In some tropical species, as for instance *Phalaenopsis grandiflora* (Fig. 9), the cells of the "suspensor" grow out in tubular fashion not only toward the exostome, but also in the opposite direction, so that the embryo proper is enveloped by the filaments.

With regard to twin-embryos, it should be noted that we now have them in both diandrous and monandrous divisions and in all the

tribes of the family. It is my purpose the coming summer to determine, if possible, the precise origin of the supernumerary embryo.

THE AMES BOTANICAL LABORATORY, North Easton, Massachusetts.

EXPLANATION OF PLATE 33. Fig. 1, twin embryos of *Goodyera tesselata*. Fig. 2 (after J. G. Hall), young embryo of *Limnocharis emarginata*. Fig. 3, embryo of *Goodyera pubescens* while still composed of few cells. Fig. 4, twin embryos of same species. Fig. 5, twin embryos of *Habenaria blephariglottis*. Fig. 6, same of *H. tridentata*. Fig. 8, seed of *Corallorhiza multiflora*. Fig. 9 (after Treub), embryo with filamentous appendage, in *Phalaenopsis grandiflora*; *e*, the embryo proper. Fig. 10, the suctorial suspensor of *Habenaria blephariglottis*. In all cases *s* indicates the suspensor, or its remains.

CHLORANTHY IN ANEMONELLA THALICTROIDES. — From Miss Emily T. Fletcher I have recently received an interesting specimen of *Anemonella thalictroides*, Spach. It has eight flowers in the usual umbelliform inflorescence, the central one being much shorter-stalked and somewhat larger than the rest. In all the flowers the sepals are small (2 to 4 mm. long) and green, instead of white and petalloid as usual. The stamens are all converted into sessile elliptic-oblanceolate green and sepaloid structures. They are 1.7 to 2.4 mm. long and rounded at the apex. The carpels are of the usual number and shape and are provided with stigmas of normal appearance. Miss Fletcher writes that the specimen was collected on the Bunce Farm at Westford, Massachusetts, where this peculiar form of the plant has been known to grow for six or seven years.

In the Gray Herbarium I find a specimen from Waterbury, Connecticut, collected and sent to Dr. Gray by Mr. W. H. Patton. In this plant the inflorescence seems originally to have been 6-flowered, although only three flowers have matured. Of these the central one, which is long-stalked and larger than usual (nearly 2 cm. in diameter) is completely transformed by chloranthy. The sepals are green although bordered with white. The stamens are represented by narrow flat elliptic-oblong slender-stiped structures, very different in their attenuate stipitate bases from those in the Westford plant. The carpels are also modified to very short and sessile but somewhat leaf-like members, quite destitute of stigmas.